United States
Environmental Protection
Agency

Office of Water
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# The Quality of Our Nation's Water: 1990

# CONTENTS

# THE QUALITY OF OUR NATION'S WATER

## Introduction

This booklet is designed to help the general reader understand the problem of water pollution in the U.S. today. Its focus is on the sources, types, impacts, and extent of water pollution, and the actions government and citizens are taking to control them.

The information in this booklet is condensed from the U.S. Environmental Protection Agency's (EPA's) *National Water Quality Inventory: 1990 Report to Congress*. The Report to Congress, in turn, is the latest in a series of reports based on water quality assessments States submit biennially to EPA. The State assessments and the Report to Congress are used to determine the quality of our Nation's water, to evaluate the effect of current water pollution control activities, and to help determine where additional action is needed. If you would like to learn more about water quality issues, you may want to begin by reading the Report to Congress or other reference material listed at the back of this booklet.

## How Clean Are Our Waters?

As this report will show, we still have a long way to go in our work to maintain and restore the quality of our Nation's water. We have water quality data for only about a third of our river miles, half of our lake acres, and three fourths of our estuarine waters. Of those waters that have been assessed, about two thirds are fully meeting the clean water goals established by Congress and the States. The rest of assessed waters show varying degrees of impairment. Significant water quality problems remain, including pollutants carried by wet weather runoff from agricultural farm lands and city streets, toxic pollutants, ground-water contamination, and loss of wetlands.

We have, nevertheless, made progress. The most obvious kinds of pollution that plagued our waters in the 1960s and 1970s–discharges of poorly treated or untreated sewage and industrial waste–have diminished in severity and extent as a result of sewage treatment plant construction and upgrading and increasingly stringent controls on industrial discharges. We are developing control strategies for the persistent pollution problem that we now know is the most widespread: polluted wet weather runoff. We are continually learning to what extent toxic contamination affects our waters, fish, and sediments.

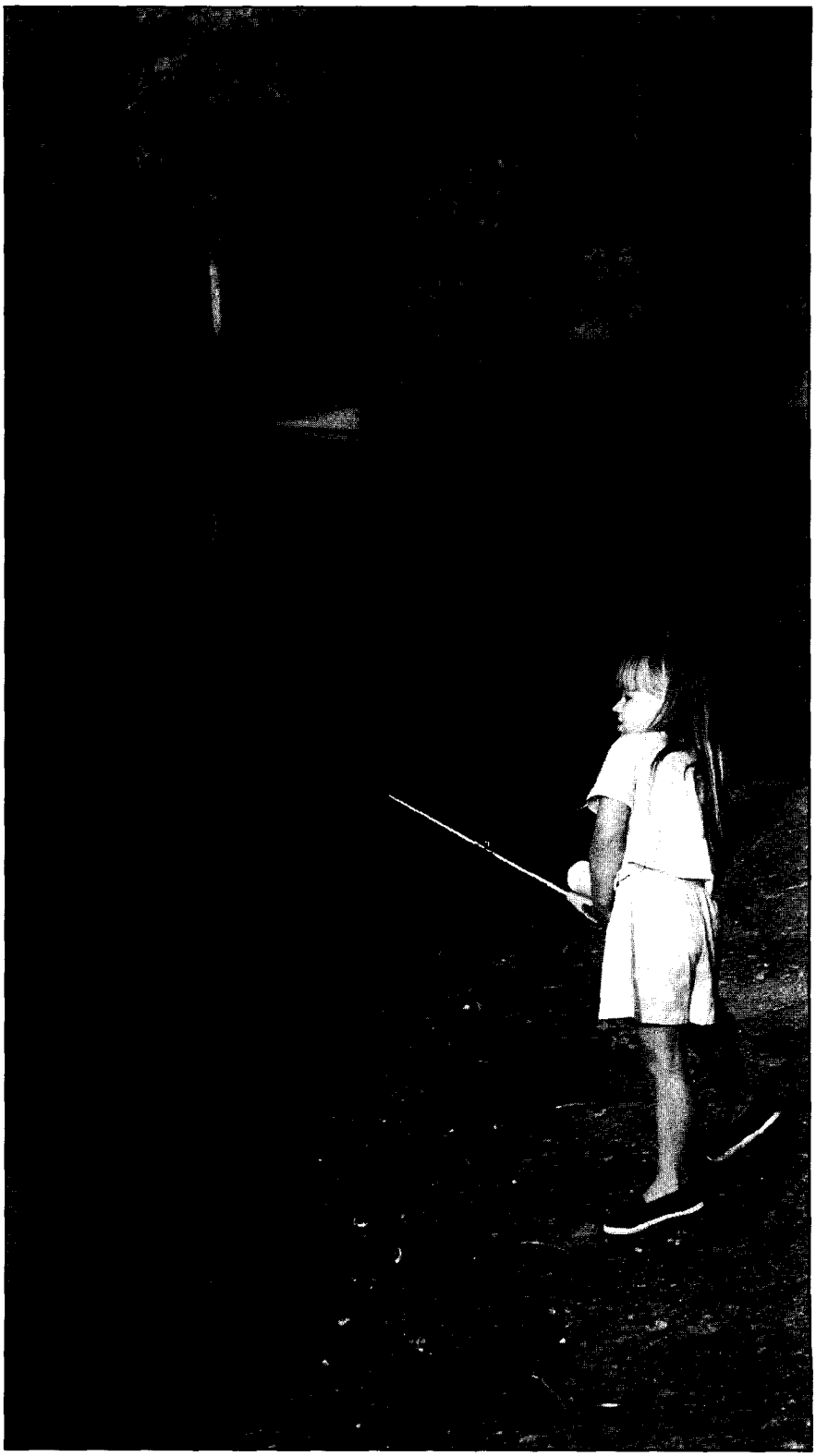
Nevertheless, there is more that water quality managers must learn about sources of pollution, specific contaminants, and their extent and impacts on the aquatic environment. Without this knowledge,we cannot design pollution controls to do the most good or direct them to where they are most needed. This need for knowledge is not limited, however, to water quality managers. Every citizen has an impact on water quality. Every citizen must become informed.


**When it rains, runoff carrying pollutants from streets, paved areas, and lawns often flows untreated into streams, lakes, and estuaries.**

## Why Is It Important To Learn About Water Pollution?

The U.S. Environmental Protection Agency firmly supports the idea that each citizen should become a steward of our precious natural resources. In this day of complex environmental threats and diminishing funds for pollution control, we must jointly solve the pollution problems that foul our swimming lakes or close the fishing spots we frequent. It is time to learn about the problems and become part of their solution. Once we know about pollution problems and what is needed to combat them, we will be better able to devise sound solutions, monitor those who are to implement the solutions, and modify any of our own personal activities that contribute to the problems.

This booklet explores some key water quality definitions and concepts; discusses different types of waters and their leading pollution problems, as reported to EPA by the States; briefly addresses some of the major Federal and State activities being carried out to control water pollution; and offers some water quality protection ideas for every citizen to consider. Throughout this booklet, we also highlight what the States are discovering about some of the most visible impacts of water pollution. ✣



Patricia Cunningham

# KEY CONCEPTS: A WATER QUALITY PRIMER

## How Much Water Is There in the U.S.?

To anyone who has ever scanned a detailed map of the U.S., our Nation's water supplies may seem infinite. In fact, current estimates tell us that the U.S. has

- About 2 million stream and river miles, including waters that flow only in wet weather;
- About 40 million acres of lakes, ponds, and reservoirs;
- About 36,000 square miles of estuaries;
- About a hundred million acres of wetlands such as marshes, swamps, bogs, and fens.

We are learning more about the extent of our water resources as computerized mapping techniques become available, and these estimates of total U.S. waters may well rise in coming years. However, the point to remember is that each mile of stream or estuary, each acre of lake or wetland, should be capable of supporting healthy aquatic life and a wide range of recreational activities.

Patricia Cunningham

*...it is the national goal that, wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water, be achieved by July 1, 1983...*

## How Do We Measure the Quality of These Waters?

In fact, it is the stated goal of the Clean Water Act of 1972 – the driving force behind the Nation's water pollution control program – that the waters of the U.S. be of "fishable" and "swimmable" quality. The U.S. EPA promotes the use of a water quality measure based on this concept.

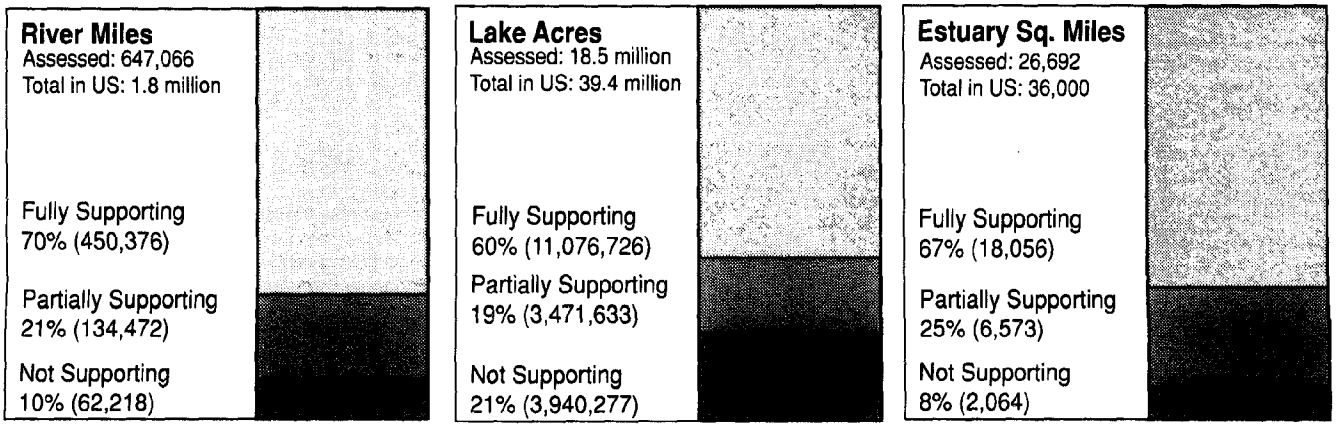
### Designated Uses

According to the Clean Water Act, all waters of the U.S. must be designated for specific uses that must then be protected. Most waters are designated for support of aquatic life – the "fishable" goal of the Act – and for contact recreation – the "swimmable" goal. A smaller set of waters are designated as public water supplies. These are waters that, with some treatment, may be piped into homes for drinking and bathing. In some States, another small subset of waters may be designated for less stringent uses such as navigation or industrial uses.

Once States have designated uses for their waters, they establish criteria to protect them. These criteria are requirements such as specific chemical concentrations or biological conditions that must be met if the uses are to be maintained. If these criteria are not met, uses may be impaired.

Together, criteria and designated uses (including a provision that waters not be allowed to degrade from a level of water quality that protects those uses) constitute each State's water quality standards. We determine the quality of our Nation's waters by measuring the degree to which standards are met and, therefore, designated uses are supported.✣

### Designated Use Support in Assessed Waters



# What is Water Pollution?

We tend to think of factories and sewage treatment facilities as the primary sources of water pollution; however, there are other, less obvious, sources of pollution that are more widespread. These less obvious sources include polluted wet weather runoff from agricultural fields, city streets, and construction sites, and hydrologic modifications such as dam building or stream channelization. Hydrologic modifications may increase erosion, remove natural streamside vegetation, affect stream flow, and degrade aquatic habitat.

The 10 general categories of water pollution sources cited in this report are described in the box below. Of the major categories of pollution sources, agricultural activities, municipal discharges, and storm sewers are the sources that States most commonly cite as problems in surface waters. On page 8 is a quick-glance summary of those pollution sources most commonly reported in our Nation's rivers, lakes, and estuaries.

These pollution sources contribute a wide variety of contaminants, ranging from excess nutrients and sediments washed from fields to toxic metals and pesticides. The leading contaminants and their impacts are summarized in the following subsections. A quick-glance summary of those contaminants most commonly reported in the Nation's rivers, lakes, and estuaries is shown on page 9.

## Nutrients

Nutrients include nitrates found in fertilizers and phosphates found in detergents. In excess levels, nutrients overstimulate the growth of aquatic plants and algae. Excessive growth of these organisms, in turn, can clog navigable waters, use up dissolved oxygen as they decompose, and block light to deeper waters. This seriously affects the respiration of fish and aquatic invertebrates, leads to a decrease in animal and plant diversity, and affects our ability to use the water for fishing, swimming, and boating. Lakes and estuaries are particularly vulnerable to the effects of excess nutrients.

### Pollution Source Categories Used in This Report

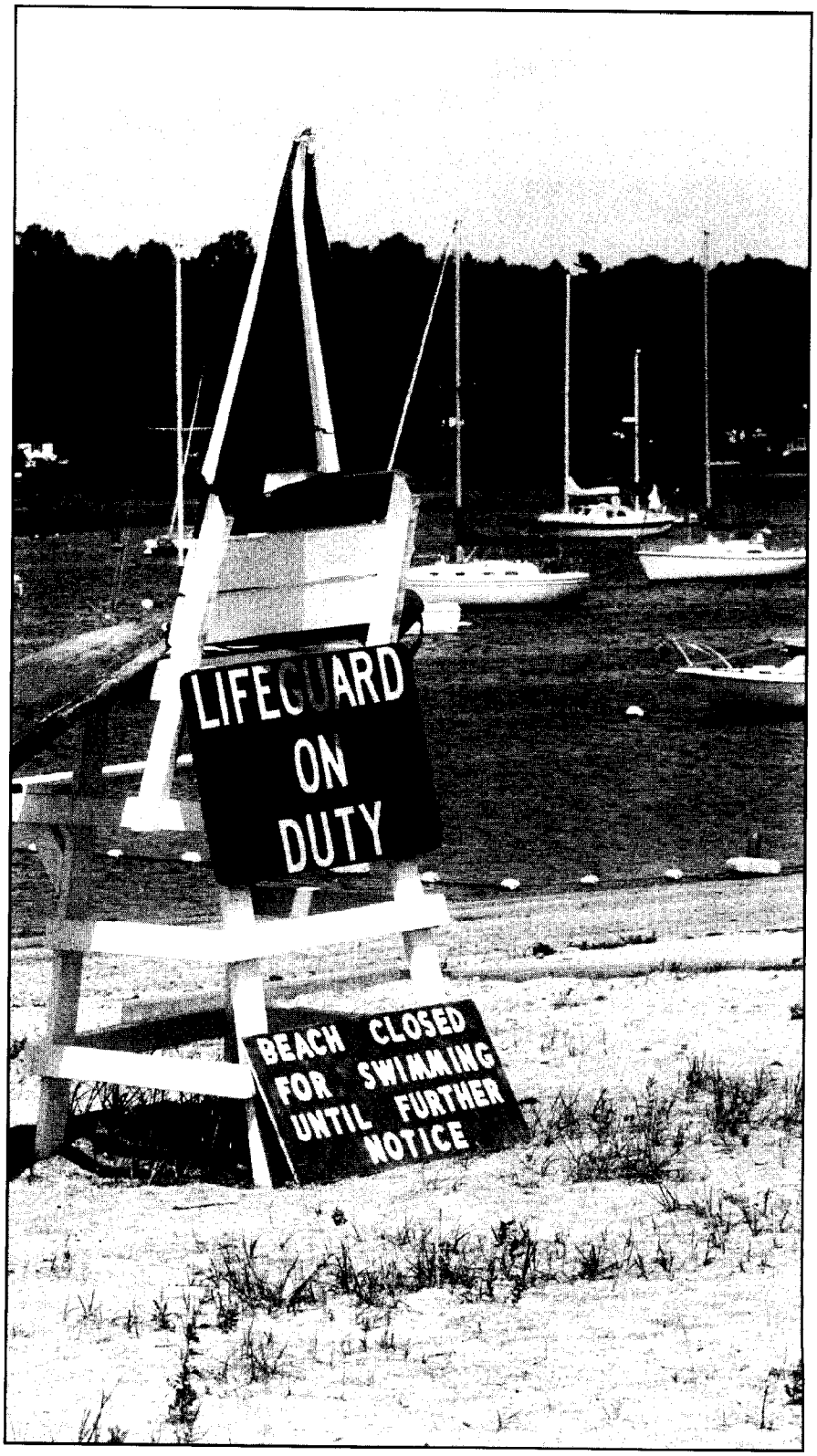
| Category | Examples |
|---|---|
| Industrial | Pulp and paper mills, chemical manufacturers, steel plants, textile manufacturers, food processing plants |
| Municipal | Publicly owned sewage treatment plants that may receive indirect discharges from small factories or businesses |
| Combined Sewers | Storm and sanitary sewers combined, which may discharge untreated wastes during storms |
| Storm Sewers/Runoff | Runoff from streets, paved areas, lawns, etc., that enters a sewer, pipe, or ditch before discharge |
| Agricultural | Crop production, pastures, rangeland, feedlots |
| Silvicultural | Forest management, harvesting, road construction |
| Construction | Highway building, land development |
| Resource Extraction | Mining, petroleum drilling, runoff from mine tailing sites |
| Land Disposal | Leachate or discharge from septic tanks, landfills, hazardous waste disposal sites |
| Hydrologic Modification | Channelization, dredging, dam construction, stream bank modification |

## Silt/Suspended Solids

When it rains, silt and other suspended solids wash off plowed fields, construction and logging sites, urban areas, strip-mined land, and eroded stream banks. As these sediments enter rivers, lakes, coastal waters, and wetlands, fish respiration is impaired, plant productivity and water depth are reduced, aquatic habitats are smothered, and our aesthetic enjoyment of the water is reduced.

## Pathogens

Certain waterborne bacteria, viruses, and protozoans can cause human illnesses that range from typhoid and dysentery to minor respiratory and skin diseases. These organisms can enter waterways through a number of routes, including inadequately treated sewage, storm water drains, septic systems, runoff from livestock pens, and boats that dump sewage. Because it is impossible to test water for every type of disease-causing organism, States generally measure fecal coliform bacteria as indicators that the water may be contaminated with untreated sewage and that other, more dangerous, organisms may be present.




Patrica Cunningham

## Organic Enrichment

Organic material may enter waterways in many different forms – as sewage, leaves and grass clippings, or as runoff from livestock feedlots and pastures. When natural bacteria and protozoa in the water break down this organic material, they begin to use up the oxygen dissolved in the water. Many types of fish and bottom-dwelling animals cannot survive when levels of dissolved oxygen drop.

## Organic Chemicals/Metals

Metals (such as mercury, lead, and cadmium) and toxic organic chemicals (such as PCBs and dioxin) may originate in industrial discharges, runoff from city streets, mining activities, leachate from landfills, and a variety of other sources. These toxic chemicals can cause death or reproductive failure in fish, shellfish, and wildlife. In addition, they can accumulate in animal tissue and be absorbed in sediments, posing long-term health risks to humans.

## Pesticides/Herbicides

Rainfall, snowmelt, and irrigation can wash pesticides and herbicides used on croplands, lawns, and in termite control into ground and surface waters. These contaminants are generally very persistent in the environment and may accumulate in fish, shellfish, and wildlife to levels that pose a risk to human health and the environment.

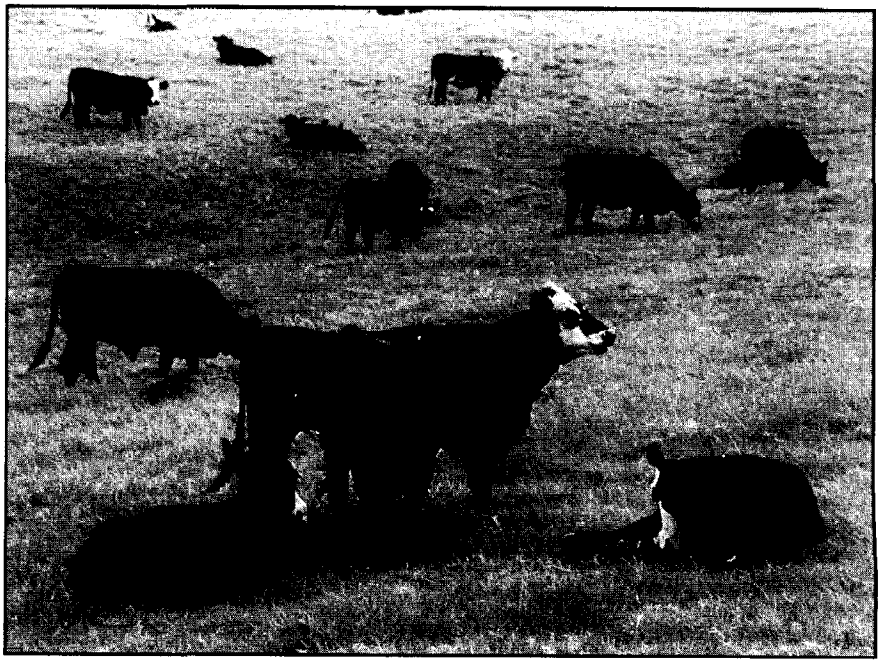
## Habitat Modification

Loss of habitat occurs when streams, lakes, and wetlands are modified by activities such as grazing, farming, channelization, dam construction, and dredging. Typical examples of the effects of hydrologic modification include loss of streamside vegetation, siltation, smothering of bottom-dwelling organisms, and increased water temperatures.

### Top Five Pollution Sources

| Source Rank | Rivers | Lakes | Estuaries |
|---|---|---|---|
| 1 | Agricultural | Agricultural | Municipal |
| 2 | Municipal | Hydrologic Modification | Storm Sewers/Runoff |
| 3 | Hydrologic Modification | Storm Sewers/Runoff | Land Disposal |
| 4 | Resource Extraction | Land Disposal | Agricultural |
| 5 | Storm Sewers/Runoff | Municipal | Construction |

Source: *National Water Quality Inventory: 1990 Report to Congress*



Patricia Cunningham

**Two of the leading sources of pollution in our Nation's water are agricultural activities and discharges from municipal sewage treatment plants.**

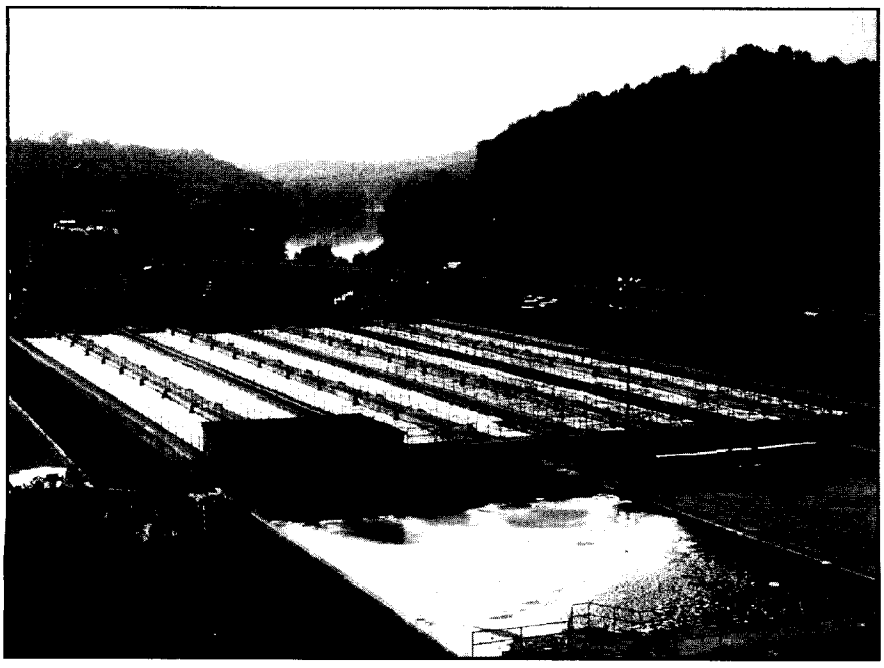
## Other Pollutants

States also report on the incidence of other pollutants. For example, fresh waters may become unfit for aquatic life and some human uses when they become contaminated by salts. Sources of salinity include irrigation runoff, brine used in oil extraction, road deicing operations, and the intrusion of sea water into ground and surface waters in coastal areas. Problems of pH are of concern in areas with many abandoned mines (acid mine drainage) and areas susceptible to acid rain. Changes in pH can alter the toxicity of other chemicals in water, and can render lakes and streams unfit for aquatic life. Other pollutants of concern include crude oil and processed petroleum products spilled during extraction, processing, or transport or leaked from underground storage tanks; noxious aquatic plants, particularly introduced species that compete against native plants; and increased water temperatures resulting from industrial cooling processes or habitat modification. ✣

### Top Five Contaminants

| Source Rank | Rivers | Lakes | Estuaries |
|---|---|---|---|
| 1 | Siltation | Metals | Nutrients |
| 2 | Nutrients | Nutrients | Organic Enrichment |
| 3 | Organic Enrichment | Organic Enrichment | Pathogens |
| 4 | Pathogens | Suspended Solids | Priority Organics |
| 5 | Metals | Noxious Aquatic Plants | Suspended Solids |

Source: *National Water Quality Inventory: 1990 Report to Congress*



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## Contaminated Sediments

Contamination of stream, lake, and estuarine sediments by toxic substances is a growing environmental concern. Toxic substances may remain in sediments for years after the pollutant source has been eliminated. Once in sediments, they may continue to contaminate surrounding water and aquatic organisms. Bottom-dwelling animals are particularly at risk. Contaminated sediments are also a problem affecting the dredging of harbors and navigation channels; contaminated dredge material is difficult to dispose of safely, and the process of dredging recirculates contaminants back into the water.

Many States do not currently have analytical resources to conduct sediment monitoring. Others may not have reported on available findings because there are no criteria against which to screen sediment data. Nevertheless, 33 States provided some information on sediment contamination in their waters. A total of 384 sites with sediment contamination were reported by the States. Leading pollutants in sediments include heavy metals, PCBs, pesticides, and dioxin.

The EPA is working with States to provide better tools to assess problems with contaminated sediments. Efforts underway include development of an EPA sediment management strategy, sediment criteria, and monitoring test for sediments. ✣

# Rivers and Streams

For centuries, our Nation's rivers and streams have been at the receiving end of discharges from a wide array of polluters. It is only recently, in a historical sense, that we have become concerned about what happens to the pollutants discharged to rivers by sewage facilities and factories or to the eroded soil washed by rainfall from agricultural fields. Certainly the prevailing belief for many years was that pollutants dumped into a river would simply get washed away and would no longer be a problem.

In fact, pollutants discharged upstream often become the problem of someone who lives downstream (or of the aquatic life that exists *instream*), and all of the activities that take place in a watershed can have a water quality impact elsewhere in the watershed. The term watershed simply refers to a geographic area in which water, sediments, and dissolved materials (contaminants) drain to a common outlet such as a point on a larger river, lake, underground water, or ocean. It is therefore important to remember that the rivers we are discussing here are inextricably connected – by hydrology, ecology, geology, and social and economic considerations – to the lakes, wetlands, and coastal and ground waters we discuss later in this booklet.

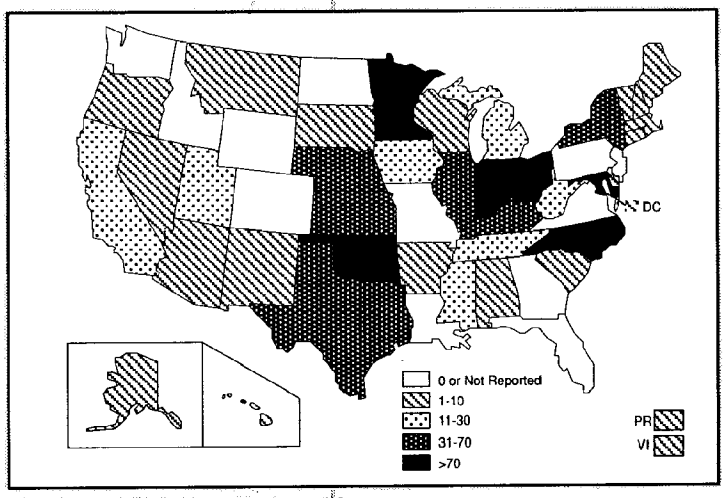
In 1990, States reported on the quality of 647,066 river miles, 36 percent of the Nation's total miles (the terms rivers and streams are used interchangeably and include major rivers such as the Mississippi, small streams that flow only in wet weather, and everything in between). This is 128,000 more stream miles than States assessed in 1988. The following figures provide a summary of the water quality of rivers, as reported to EPA by the States.

## Fish Kills

One of the most obvious signs of water pollution problems is the fish kill: dead fish floating on the surface of the water or washed up on the shoreline. Our fish kill statistics are incomplete, for a number of reasons.

Fish kill reporting is an entirely voluntary process; States are not required to report on how many fish kills occur, or what might have caused them. In many cases it is the public – fishermen and hunters, recreational boaters, or hikers – who first notice fish kills and report them to game wardens or other State officials. Many fish kills may go undetected or unreported, and others may be difficult to investigate, especially if they occur in remote areas. This is because dead fish may be carried quickly downstream, or may be difficult to count because of turbid conditions. It is therefore likely that the statistics presented by the States underestimate the total number of fish kills that occurred nationwide between 1988 and 1990.

Despite these problems, fish kills are an important consideration in water quality assessments, and State reporting on the number and causes of kills is improving. In 1990, 42 States reported on a total of 1,365 fish kill incidents. Almost 26 million fish were reported killed. Pollutants most often cited as the cause of kills included pesticides, biochemical oxygen-demanding substances, oil and gas, chlorine, temperature changes, ammonia, organics, and acidity. Leading sources of fish kills include industrial discharges, agricultural activities, municipal sewage treatment plant discharges, spills, and mining activities. ✣

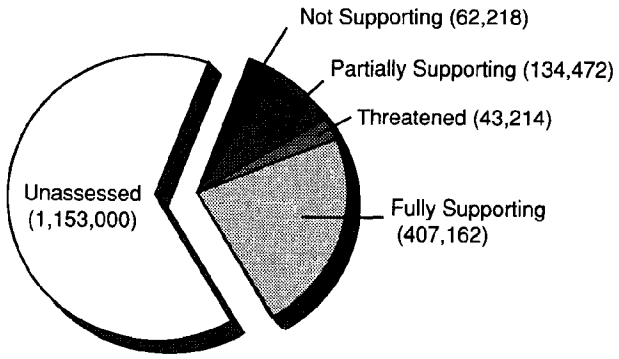



**Number of Fish Kills Nationwide**

## Do Our Rivers and Streams Support Uses?

Of the Nation's 647,066 assessed river miles, 63 percent were found to fully support their designated uses, and an additional 7 percent support uses but are threatened and may become impaired if pollution control actions are not taken. Nearly 21 percent were reported as partially supporting uses, and the remaining 10 percent of river miles were found to be not supporting designated uses.

### Use Support in Rivers and Streams

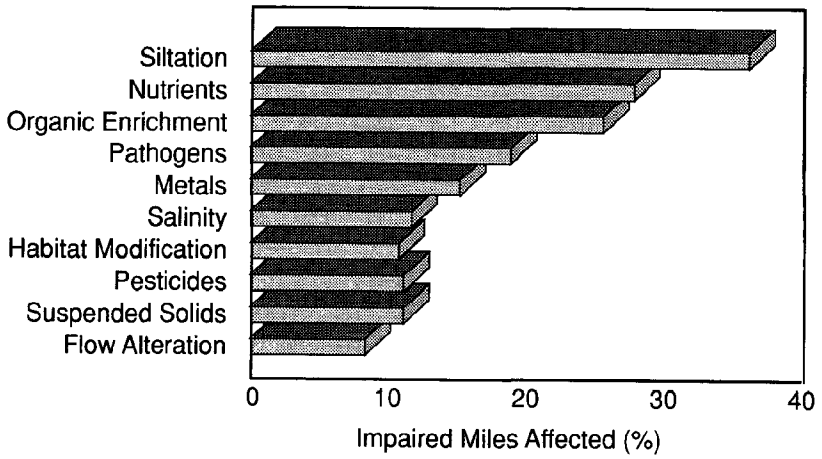



Total River Miles: 1,800,066

## What Is Polluting Our Rivers and Streams?

As reported by the States in 1990, those pollutants that most commonly contribute to impairment in rivers are siltation and nutrients, affecting 36 percent and 28 percent of impaired stream miles, respectively. Other leading causes of impairment include organic enrichment and resultant low levels of dissolved oxygen, affecting 26 percent of impaired stream miles, and indicators of pathogens, affecting 19 percent.

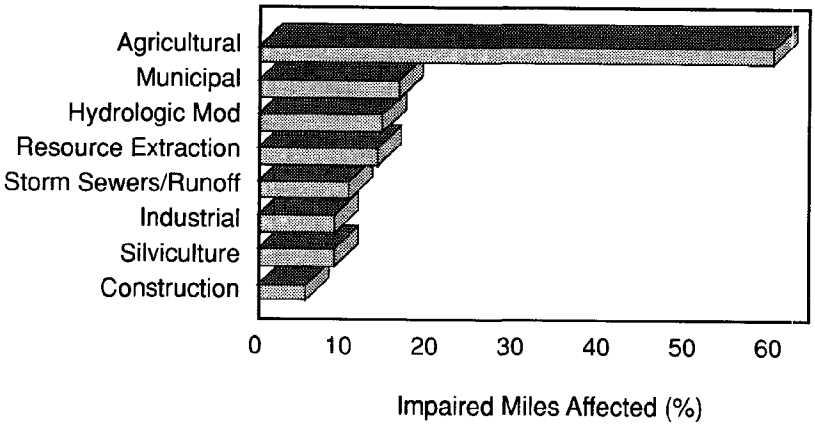
### Top Ten Pollutants in Rivers and Streams




## Where Does This Pollution Come From?

Leading sources of these pollutants in rivers include agricultural runoff – by far the most widely reported source, affecting 61 percent of impaired stream miles – municipal discharges, affecting 16 percent, and modifications to the hydrology and habitat of streams, affecting 15 percent. ✣

### Sources of Pollution in Rivers and Streams



# LAKES AND RESERVOIRS

Many lakes evolve naturally over time, filling with sediments and organic matter that alter many basic characteristics such as depth, biological productivity, oxygen levels, and water clarity. This natural "aging" process is known as eutrophication.

Human activities can speed eutrophication by increasing the amounts of nutrients and organic substances that enter lakes from their surrounding watersheds through wet weather runoff, leaking septic systems, sewage discharges, eroded streambanks, and similar sources. These substances can overstimulate the growth of algae and aquatic plants, creating conditions that interfere with the recreational use of lakes and the health and diversity of indigenous fish and plant populations.

Eutrophication due to human activities is one of the leading problems facing our Nation's lakes and reservoirs. The eutrophication progression is commonly defined by a series of trophic states as described in the box below.

In 1990, 38 States reported that half of the lakes they assessed for trophic status were either eutrophic or hypereutrophic, 39 percent were mesotrophic, 10 percent were oligotrophic, and less than 1 percent were dystrophic. This information may be somewhat biased, as States often assess lakes in response to a problem or public complaint or because of their easy accessibility. It is likely that more remote lakes – which are probably less impaired – are underrepresented in these assessments.

The 1987 amendments to the Clean Water Act emphasized the need for information on a number of significant problems other than the more traditional indicators of trophic status. Many States are therefore expanding their lake monitoring efforts to detect potential effects of acid deposition (acid rain), acid mine drainage, and toxic substances. In some areas of the country, impacts from these problems are severe: increases in lake acidity can radically alter the community of fish and plant species in lakes and can increase the solubility of toxic substances and magnify their adverse effects.

## EPA's Clean Lakes Program

The Clean Water Act established the Clean Lakes Program in 1972 in response to widespread public support for preserving and protecting our Nation's lakes. In the Clean Lakes program, EPA provides Federal funds to help States carry out diagnostic studies of lake problems, determine necessary protection and restoration measures, implement those measures, and monitor the long-term impacts and effectiveness of those measures.

Successful lake programs require strong local support and cooperation from natural resource agencies at the local, State, and Federal levels. Many States have made great progress in establishing these types of cooperative frameworks for managing lakes under the Clean Lakes Program.

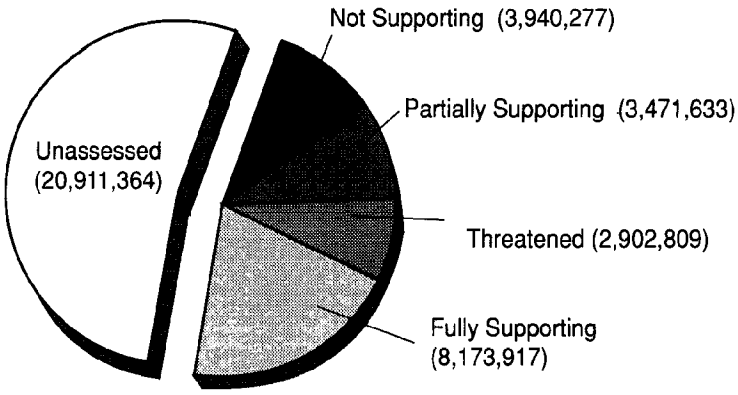
### Trophic States

| | |
|---|---|
| **Oligotrophic** | Clear waters with little organic matter or sediment, and minimum biological activity. |
| **Mesotrophic** | Waters with more nutrients and, therefore, more biological productivity. |
| **Eutrophic** | Waters extremely rich in nutrients, with high biological productivity. Some species may be choked out. |
| **Hypereutrophic** | Murky, highly productive waters, closest to the wetland status. Many clearwater species cannot survive. |
| **Dystrophic** | Low in nutrients, highly colored with dissolved humic organic matter. (Not necessarily a part of the natural trophic progression.) |

## Do Our Lakes and Reservoirs Support Uses?

Of our Nation's 39.4 million acres of lakes and reservoirs, 47 percent were assessed by the States in 1990. Of those, 44 percent were found to fully support designated uses such as swimming, fishing, and water supply. An additional 16 percent were identified as threatened and could soon become impaired if pollution control actions are not taken. States reported 19 percent of assessed lake acres as partially supporting uses and 21 percent as not supporting uses.

### Use Support in Lakes and Reservoirs

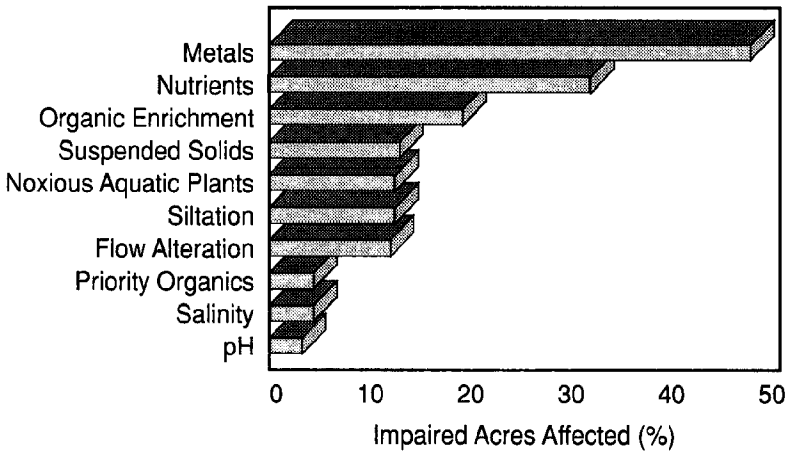



Total Lake Acres: 39,400,000

## What Is Polluting Our Lakes and Reservoirs?

Metals and nutrients were reported by the States as the most common causes of nonsupport in assessed lakes, affecting 48 percent and 32 percent of impaired lake acres, respectively. (Three-quarters of the total acres affected by metals were in one State, which attributed this problem to mercury accumulation in fish from atmospheric deposition.) Another leading cause of lake impairment was organic enrichment, affecting 19 percent of impaired lake acres.

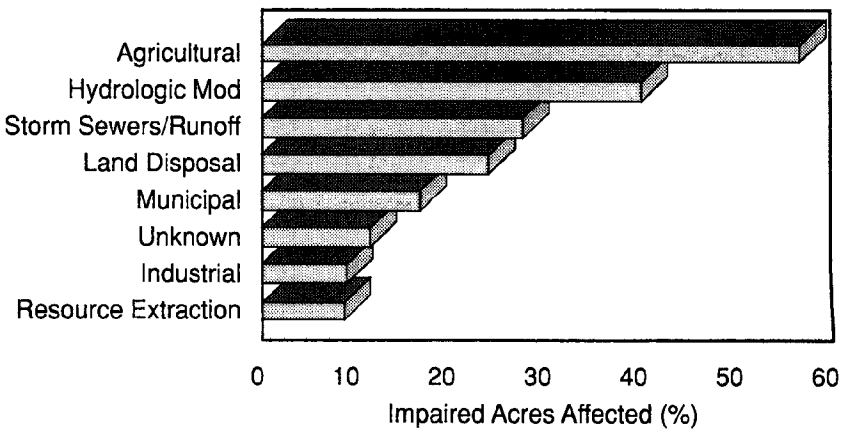
### Top Ten Pollutants in Lakes and Reservoirs




## Where Does This Pollution Come From?

Agricultural runoff is reported as the most extensive source of pollution in lakes, affecting 57 percent of impaired lake acres. Other leading sources in lakes include hydrologic modifications, affecting 40 percent; storm sewers/runoff, affecting 28 percent; land disposal (septic tanks), affecting 24 percent; and municipal discharges, affecting 17 percent. ❖

### Sources of Pollution in Lakes and Reservoirs



# THE GREAT LAKES

The Great Lakes, containing one-fifth of the world's fresh water, are stressed by a wide range of pollution sources. These sources include municipal and industrial discharges, combined sewer overflows, runoff from urban areas, atmospheric deposition (e.g., acid rain), contaminated sediments, and hazardous waste sites associated with the large urban centers located on the shores of the Great Lakes.

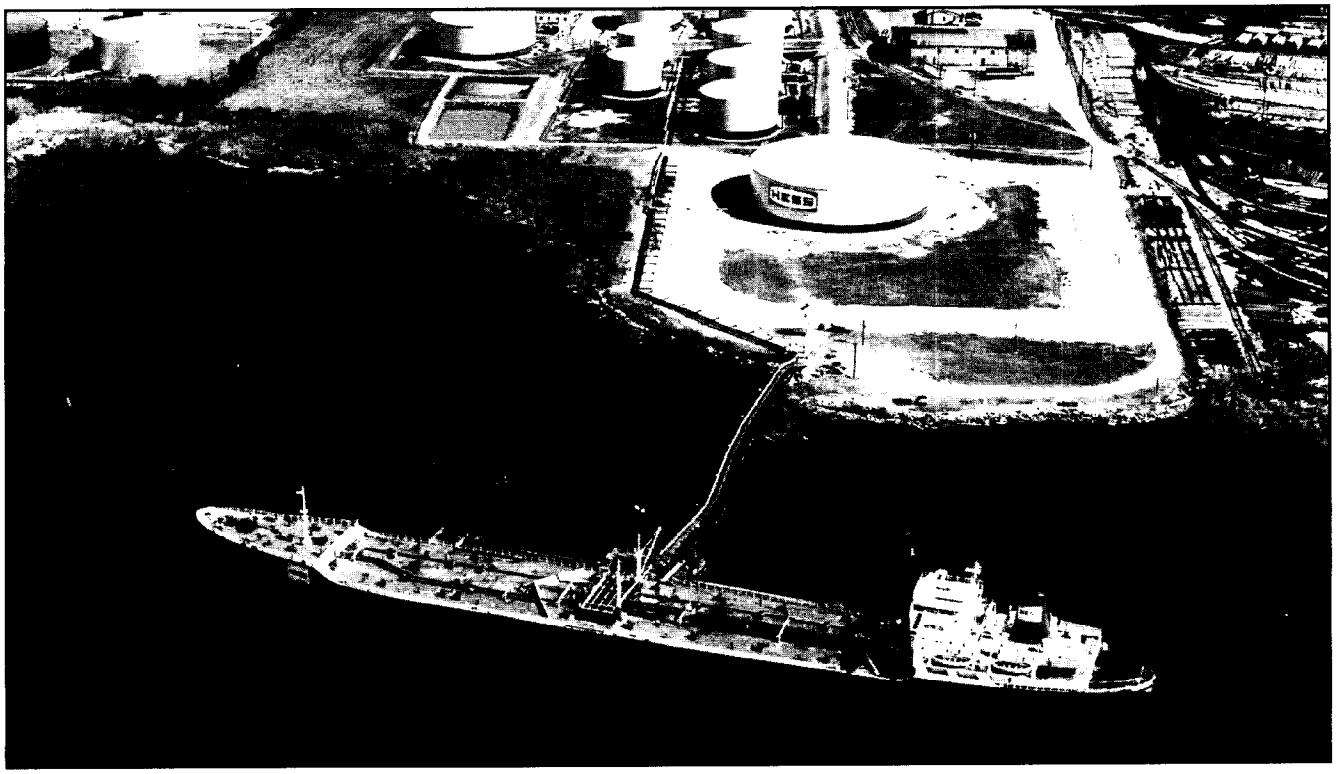
Many of these sources are particularly difficult to control because of their diffuse origins. Furthermore, because the Great Lakes are a relatively closed water system, many of the pollutants that reach them remain in the system indefinitely.

All Great Lakes States report restrictions on the consumption of certain fish species in nearshore waters. Pollutants of particular concern affecting fish are PCBs, DDT, and mercury. Atmospheric deposition and sediment contamination from previous activities such as industrial discharges are thought to be significant sources of fish contamination. Sediment contamination is a major problem in nearshore waters and harbors.

Since 1973, 42 Areas of Concern have been identified in the Great Lakes basin where environmental quality is substantially degraded. Most Areas of Concern are harbors, bays, and river mouths. Remedial Action Plans have been developed for each Area of Concern. These plans include identifying impaired uses and examining how best to restore the areas.

## A Water Quality Partnership

The Great Lakes are cooperatively managed by the U.S. and Canada under the Great Lakes Water Quality Agreement of 1978 (as amended in 1987). The International Joint Commission, established by the 1909 Boundary Waters Treaty, is responsible for identifying actions to protect the Great Lakes. Representatives from State and Federal agencies and universities work together on the Commission's two boards to identify problem areas, plan programs to reduce pollution, and publish findings and issue papers.

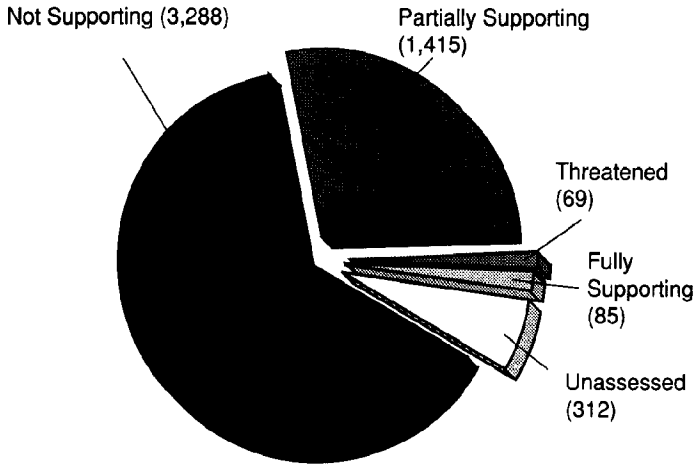


**The Great Lakes are stressed by a variety of activities associated with the large cities on their shores.**

## Do the Great Lakes Support Uses?

Ninety-four percent of total Great Lakes shoreline miles were assessed by the States in 1990. Of these, only 3 percent fully support uses. The reason for the low rate of use support is fish consumption advisories issued by the Great Lakes States and the Province of Ontario for the nearshore waters of the Great Lakes. Twenty-nine percent of assessed shoreline miles partially support uses, and the remaining 68 percent do not support uses. These figures do not address water quality conditions in the deeper, cleaner, central waters of the Lakes.

### Use Support in the Great Lakes

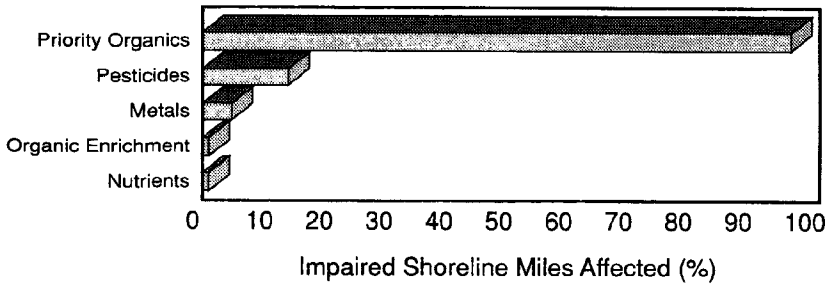



Total Great Lakes Shoreline Miles: 5,169

## What Is Polluting the Great Lakes?

Toxic organic chemicals – primarily PCBs – are the leading contributor to impairment in 99 percent of impaired Great Lakes shoreline miles. Other leading causes of impairment include pesticides, affecting 14 percent, and metals, affecting 5 percent.

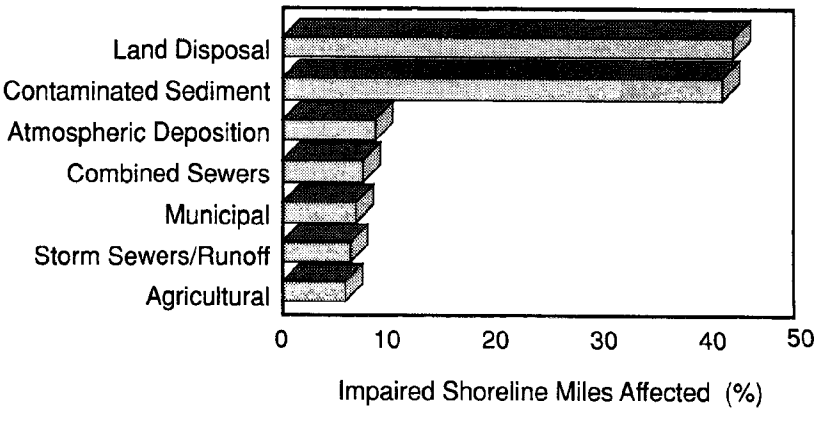
### Top Pollutants in the Great Lakes




## Where Does This Pollution Come From?

Although information on sources of pollution in the Great Lakes is sketchy, the reported information suggests that landfills and contaminated sediments are the leading sources impairing Great Lakes waters. Other sources cited by the States include atmospheric deposition, combined sewers, and municipal discharges. ✣

### Sources of Pollution in the Great Lakes



# ESTUARIES

Estuaries are areas partially surrounded by land where rivers meet the sea. They are characterized by varying degrees of salinity, complex water movements affected by ocean tides and river currents, and high turbidity levels. They are also highly productive ecosystems with a range of habitats for many different species of plants and animals.

Among the plant species found in estuaries are submerged sea grasses, salt marsh plants, algae and phytoplankton. Animal species include bottom-dwelling organisms such as oysters, clams, and lobsters; fish such as sea trout, striped bass, and flounder; and birds such as sea gulls, cormorants, and pelicans. Many species permanently inhabit the estuarine ecosystem; others, such as salmon and shrimp, use the nutrient-rich estuarine waters as nurseries before traveling to the sea.

Estuaries are stressed by the particularly wide range of activities located within their watersheds. They receive pollutants carried by rivers from agricultural lands and cities; they often support marinas, harbors, and commercial fishing fleets; and their surrounding lands are highly prized for development. These stresses pose a continuing threat to the survival of these bountiful waters.

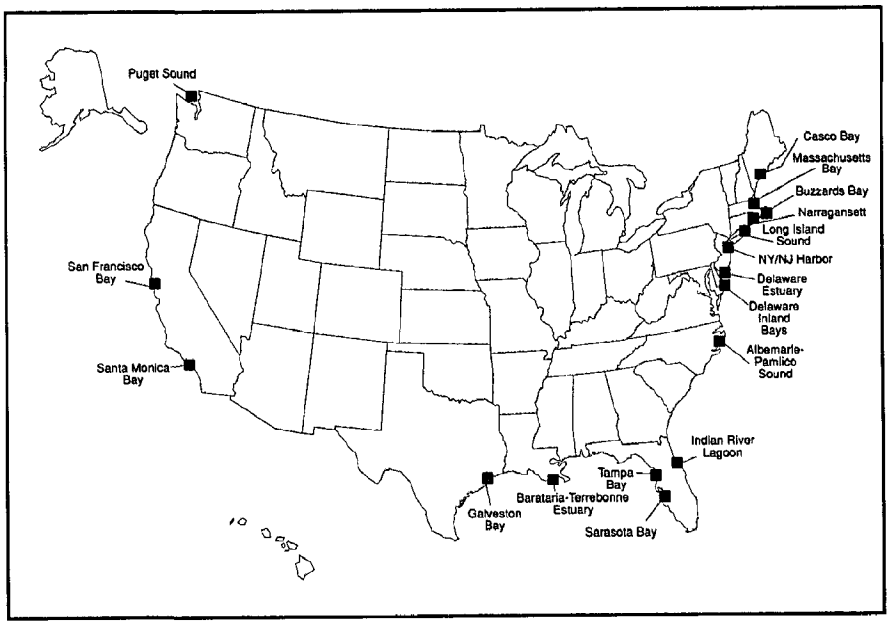
## Protecting Estuaries: A Watershed Approach

Section 320 of the Clean Water Act (as amended by the Water Quality Act of 1987) established the National Estuary Program (NEP) to protect and restore water quality and living resources in estuaries. The NEP adopts a geographic or watershed approach by planning and implementing pollution abatement activities for the estuary and its surrounding land area as a whole.

Through the NEP, States nominate estuaries of national significance that are threatened or impaired by pollution, development, or overuse. EPA evaluates the nominations and selects those that show evidence of a committed citizenry, political support, a range of government involvement (State, Federal, regional, and local), and available scientific and technical expertise to tackle the problem. The EPA convenes management conferences with representatives from all interested groups (e.g., industry, agriculture, conservation organizations, and State agencies) to more fully characterize the problems and seek solutions.

The NEP is also a national demonstration program. There are more than 150 estuaries in the U.S. and only a small fraction can be targeted for action through the NEP. It is therefore important that the lessons learned through the NEP be communicated to estuarine water quality managers throughout the country. As of May 1992, 17 estuaries are included in the NEP.

Thoma

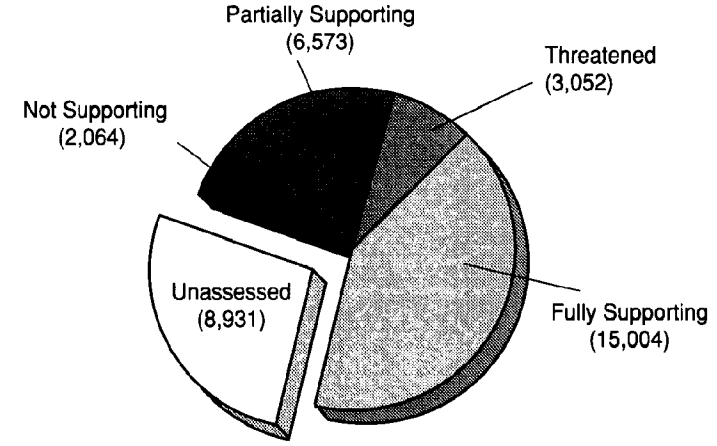



**Estuaries Participating in the National Estuary Program**

## Do Our Estuaries Support Uses?

Roughly three quarters of the Nation's total estuarine waters were assessed by the States in 1990. Of these, 56 percent were found to fully support designated uses. An additional 11 percent are considered threatened and could become impaired if pollution control actions are not taken. Twenty-five percent of assessed estuarine square miles partially support uses, and the remaining 8 percent do not support uses.

### Use Support in Estuaries

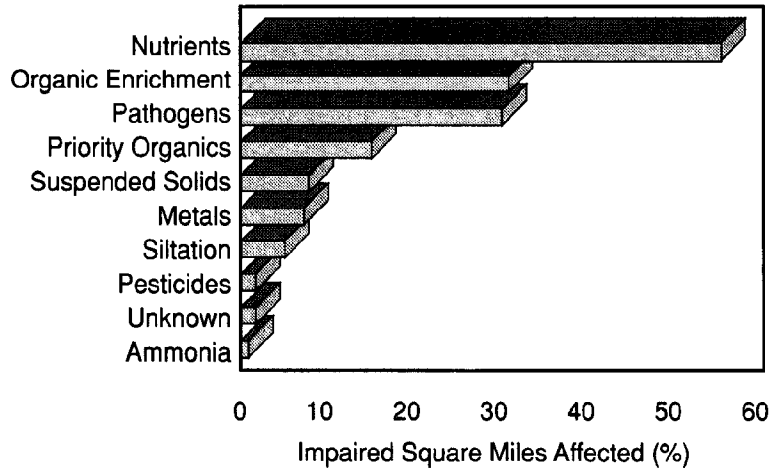



Total Estuary Square Miles: 35,624

## What Is Polluting Our Estuaries?

States report that the most common causes of nonsupport of designated uses in our Nation's estuaries are nutrients, affecting 55 percent of impaired square miles; organic enrichment and resulting low levels of dissolved oxygen, affecting 31 percent; and pathogens, affecting 30 percent. Pathogen contamination is responsible for the closure of shellfishing beds in many areas of the country. It should be noted that over half the States with estuaries did not provide information on specific pollutants in their waters.

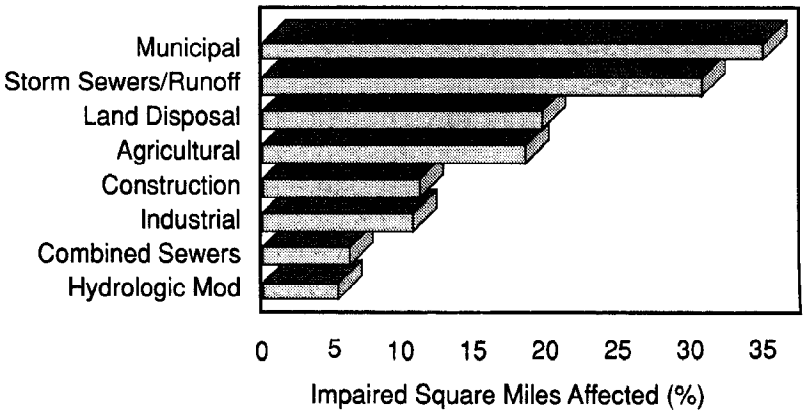
### Top Ten Pollutants in Estuaries




## Where Does This Pollution Come From?

States report that municipal dischargers and storm sewers/runoff are the leading sources of pollution in their estuarine waters, affecting 35 percent and 30 percent of impaired estuarine square miles, respectively. Other leading sources cited by the States include land disposal (septic systems) and agricultural runoff. ❖

### Sources of Pollution in Estuaries



# Ocean Coastal Waters

We know less about the condition of our ocean coastal waters than we do about our estuarine or inland waters. In part, this may be because we tend to think that only oil spills or similar disastrous events could possibly affect a resource as vast as an ocean.

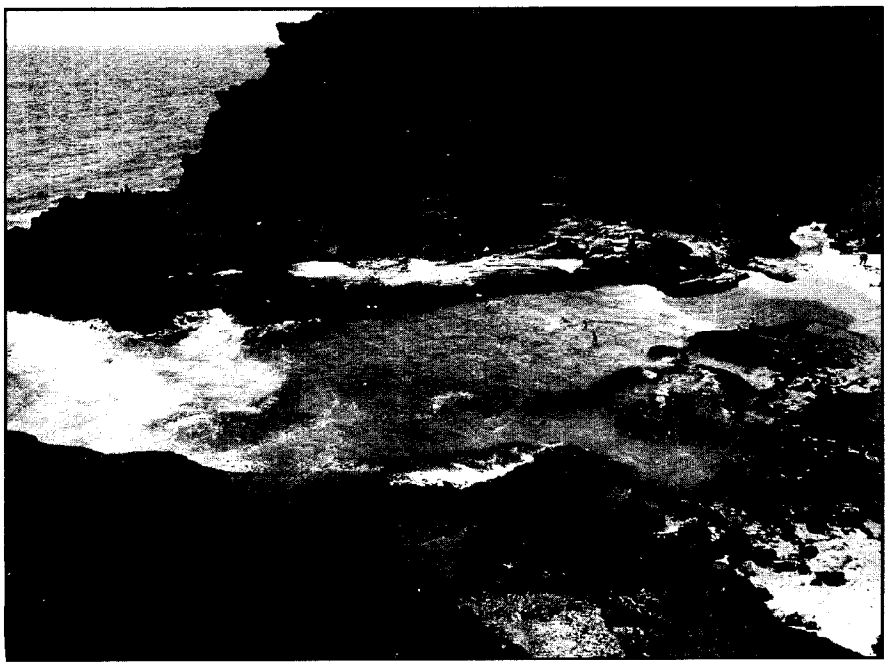
In fact, we are seeing evidence that our ocean waters–particularly the waters near our coasts–suffer from the same pollution problems that affect our inland waters. Beach debris cleanups are cataloging tons of trash carried into the oceans by rivers, washed in from city storm sewers, thrown in by beach visitors, or dumped overboard by boaters. Beaches are closed to swimming every summer due to pathogens from inadequately treated wastes. Marine mammals are suffering from pollution-related stresses. Fragile coral reefs in Florida and Hawaii show signs of pollution impacts. Coastal development is increasing at a rapid rate. Clearly we can no longer pretend that the oceans can take care of themselves.

## Protecting Coastal Waters

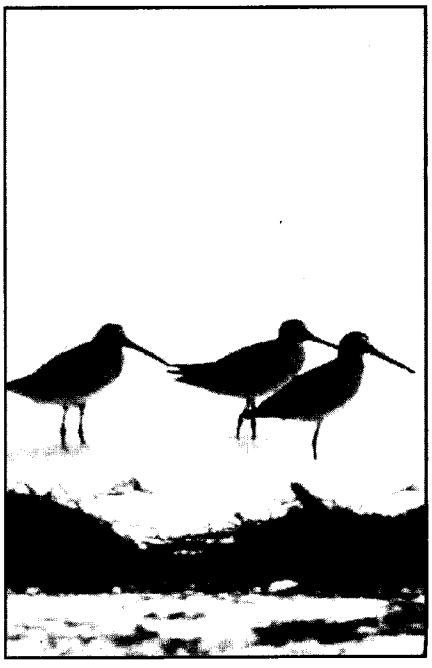
EPA's Near Coastal Waters Program is a long-term blueprint for improving environmental management of near coastal waters. Like the National Estuary Program, the Near Coastal Waters (NCW) Program focuses on a geographically targeted watershed approach. Its goal is to protect all near coastal bays, lagoons, coves, freshwater Great Lakes coasts, and other coastal waterbodies. Demonstration projects have been developed and regional strategies implemented to target geographic areas for special protection. Implementation projects include restoring coastal wetlands, tightening enforcement of water quality regulations, and incorporating best management practices to control wet weather runoff in coastal areas.

One of the tools to protect coastal waters is EPA's National Coastal and Marine Policy. The goals of the Policy are to recover the full recreational use of ocean beaches; to restore the Nation's shellfisheries, saltwater fisheries, and other living resources by controlling pollution and causes of habitat destruction and loss; to minimize the use of coastal and marine waters for waste disposal; to expand scientific research and monitoring in coastal and marine ecosystems; and to take a leadership role to protect the world's oceans by promoting international efforts to stop pollution and protect habitat.

EPA has joined in partnership with other Federal agencies in the Coastal America program to coordinate Federal activities and authority in protecting coastal living resources and to forge similar alliances at the State and local levels. Coastal America will be supporting protective environmental projects in coastal areas around the country.



Patricia Cunningham

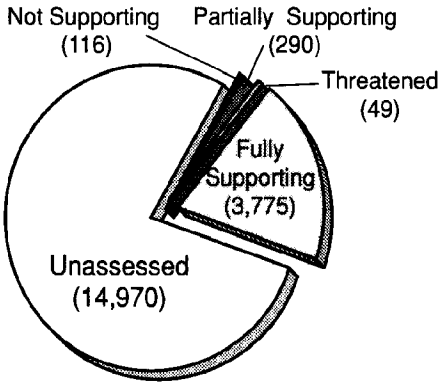


O.S. Pettingill, Cornell Lab. of Ornithology

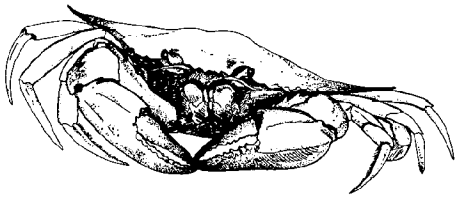
## Do Our Ocean Coastal Waters Support Uses?

Only about 22 percent of the Nation's estimated 19,200 miles of ocean coastline have been assessed by the States. Of these, 89 percent were found to fully support their designated uses, and 1 percent are threatened and likely to become impaired if pollution control actions are not taken. Seven percent of assessed coastal miles partially support designated uses, and 3 percent do not support uses. These figures are not necessarily representative of the Nation as a whole because they apply to so few coastline miles. Data on pollutants and sources of pollution are too sparse to be included in this report. ✣

## Use Support in Oceans




Total Ocean Coastline Miles: 19,200



Patricia Cunningham

## Shellfish Harvesting Restrictions

Many coastal States report restrictions on shellfish harvesting in estuarine waters. Shellfish – particularly oysters, clams and mussels – are filter-feeders that extract their food from water. Waterborne bacteria and viruses may also accumulate on their gills and mantles and in their digestive systems. Shellfish contaminated by these microorganisms are a serious human health concern, particularly when shellfish are consumed raw.

States currently sample water from shellfish harvesting areas to measure total coliform and fecal coliform bacteria. These bacteria serve as indicators of the presence of potentially pathogenic microorganisms associated with untreated or undertreated sewage. States restrict shellfish harvesting to areas that maintain these bacteria at concentrations in sea water below established health limits.

In 1990, 20 States reported that shellfish harvesting restrictions were in effect for portions of their estuarine and coastal waters during the 1988-90 reporting period. A total of 340 restrictions were reported, covering a total of 2,018 square miles of estuarine waters. The most commonly reported reasons for restrictions on shellfish harvesting include municipal wastewater treatment facilities, urban runoff or storm sewers, septic systems, marinas, and industrial discharges. ✣

# WETLANDS

Wetlands are areas that are either flooded or saturated by water for varying periods of time during the growing season. Wetlands are characterized by plants that are well adapted to wet conditions and by certain soil types.

In the past, wetlands were considered wastelands -- the source of mosquitoes, flies, and unpleasant odors – to be filled or drained and put to "better use." When European settlers first arrived in America, over 200 million acres of wetlands existed. Today, half of our Nation's wetlands have been destroyed by filling, draining, pollution, channelizing, grazing, clearing, and other modifications resulting from human activity.

## Fragile Treasures

Wetlands are now recognized as some of the most unique and important natural areas on earth. They vary in type according to differences in local and regional hydrology, vegetation, water chemistry, soils, topography, and climate. Coastal wetlands include estuarine marshes; mangrove swamps found in Puerto Rico, Hawaii, and Florida; and Great Lakes coastal wetlands. Inland wetlands – common on floodplains along rivers and the margins of lakes and ponds – include marshes and wet meadows, bottomland hardwood forests, Great Plains prairie potholes, cypress-gum swamps, and southwestern playa lakes.

Wetlands provide food and shelter to countless animal species including many fishes, birds, reptiles, and mammals. Forty-five percent of federally listed threatened or endangered animals and 26 percent of listed plants depend directly or indirectly on wetlands for some portion of their life cycles. Wetlands also provide habitat for a vast majority of the commercial fish and shellfish species consumed in this country. In addition, they also serve as feeding areas along migration routes for waterfowl and other wildlife.

Wetland soil and vegetation help in flood control by acting as natural sponges that absorb flooding water. Wetland plants also help control erosion in two ways: their roots bind the soil and their leaves slow the movement of water. Wetlands help purify water by processing nutrients and other pollutants and filtering suspended materials. They also help regulate water quantity by absorbing water in wet seasons and releasing it through seeps, springs, and open outlets during dry seasons.

In addition, wetlands are widely enjoyed by hikers, birdwatchers, hunters, fishermen, photographers, and boaters and play an important role in our Nation's natural and cultural heritage.

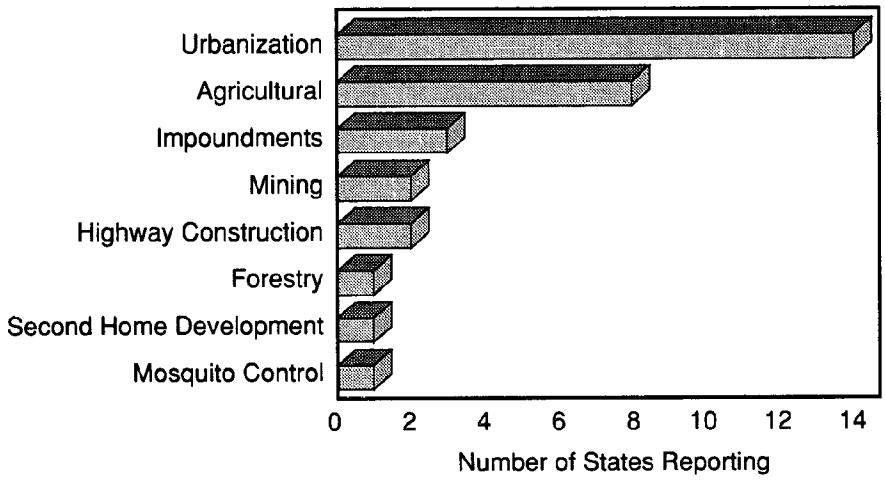
## Wetland Loss: A Continuing Problem

Despite what we have learned about the value of our wetlands, these national treasures continue to be threatened by a variety of human activities. A U.S. Fish and Wildlife Service study of wetland loss found that 2.6 million acres of wetlands were lost over the 9-year study period from the mid-1970s to the mid-1980s.

In 1990, 16 States reported on the reasons why wetlands are being lost. Although many historic wetlands losses were due to conversion of wetlands for agricultural uses, States now report that commercial and residential development currently is the leading source of wetland loss. Other reasons include agricultural and irrigation projects, construction of impoundments, mining activities, and highway construction.

Among States that reported on water quality concerns in their wetlands, sedimentation and increasing salinity were cited as leading causes of degradation.

### Sources of Wetland Losses



# Protecting the Treasure

We are making progress in assessing the threats to our wetland resources and developing wetland protection programs. However, much work remains to be done to fully identify and assess remaining wetland resources, develop regulatory tools, and implement protection programs nationwide.

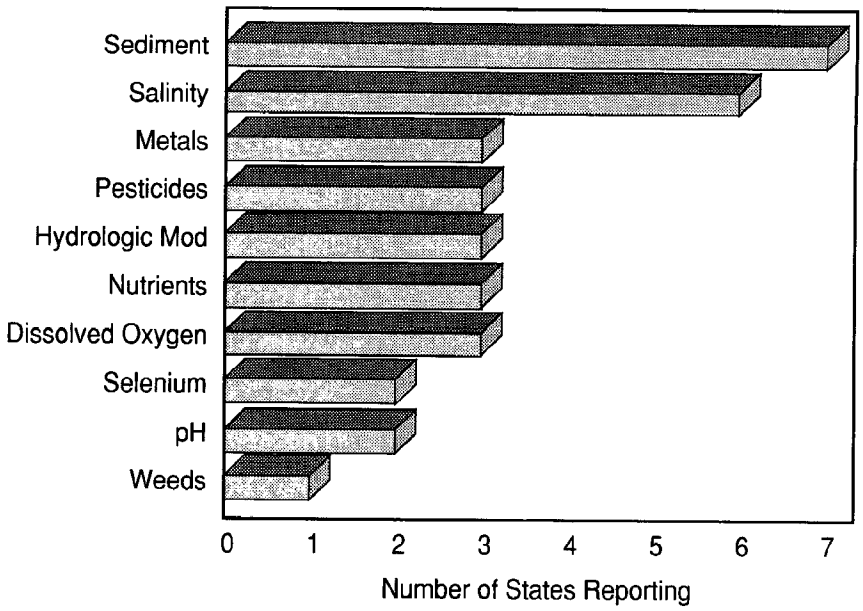
One of the first steps in broadening wetlands protection is to develop water quality standards for wetlands and to define them as "waters of the State," subject to the same protective provisions of the Clean Water Act as apply to other surface waters. EPA issued guidance in 1990 to help States develop these standards by 1993.

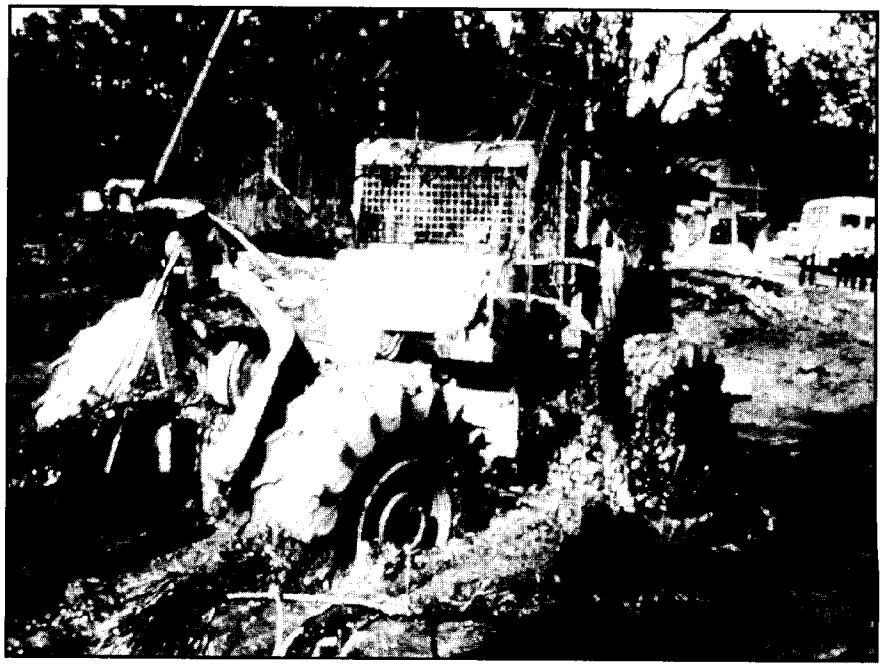
The leading Federal regulatory program for the protection of wetlands is Section 404 of the Clean Water Act. Section 404 gives the U.S. Army Corps of Engineers and EPA the authority to issue permits to protect the environment from the adverse effects of the discharge of dredged or fill material. The Corps reviews about 13,000 applications a year for projects that might affect wetlands. EPA and other agencies assist in the review and approval or disapproval of these projects.

States protect their wetlands with a variety of programs related to permitting, restoration, wetlands acquisition, coastal management, and natural heritage conservation. At present, however, only a few States have completed developing water quality standards for wetlands, and coastal wetlands appear to receive more regulatory protection than inland wetlands.

Beginning in 1990, EPA established a grant program to support State wetland protection programs. These grants have been used for a range of efforts such as developing water quality standards, monitoring trends in wetland loss, coordinating State and local planning agencies, and disseminating educational materials on wetlands. ✣

## Wetland Water Quality Problems



**The leading source of wetland loss reported by the States is commercial and residential development.**

# GROUND WATER

Ground water – water found in natural underground rock formations called aquifers – is a vital natural resource with many uses. In many parts of the country, ground water is the only reliable source of drinking water. Although the Nation's ground water is of generally good quality, an increasing number of pollution incidents affecting both public water supplies and private wells has been reported throughout the country.

## Our Uses of Ground Water

About 51 percent of the population of the U.S. relies to some extent on ground water as a source of drinking water. In rural areas, most residents rely on potable or treatable ground-water sources to provide economical supplies of water for domestic use. In fact, in nine States ground water provides drinking water for 75 percent or more of the population.

Ground water is also used for irrigation, industrial cooling and processing, and livestock watering. In the East and South, ground-water withdrawals are primarily for industrial and domestic purposes; in the arid West, most ground water is withdrawn for irrigation.

## Protecting Our Ground-Water Resources

Many States are developing and expanding regulations, legislation, and programs needed to protect their ground-water resources. The need to protect ground water before it becomes contaminated is critical: ground-water cleanup is particularly complex and expensive, and alternative supplies of water may be difficult to obtain.

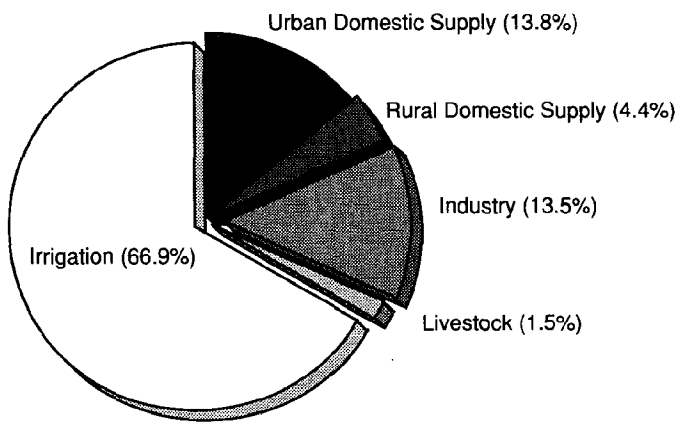
Ground-water protection can be achieved through a variety of means, including pollution prevention programs, source controls, siting controls, the protection of wellhead areas and future public water supply areas, and the protection of aquifer recharge areas. The primary responsibility for coordinating and implementing ground-water protection programs is vested in the States, although Federal, State, and local activities should all be linked in a coordinated plan of action.

According to information provided by the States in 1990, 44 States have adopted ground-water protection strategies. These strategies typically outline goals for addressing ground-water problems; outline a system to classify ground-water resources and monitor the health of those resources; provide mechanisms for coordinated government action for preventing contamination; and describe regulatory programs.

In addition, 37 States report some form of current or pending ground-water legislation that focuses on the need for increased data collection, public education activities, and the establishment of technical controls. Forty-one States report that they have adopted ground-water protection standards either describing general goals for nondegradation of ground-water supplies or establishing threshold, health-based concentrations for specific compounds. States are also engaged in mapping their ground-water resources and the extent of contamination and are developing innovative programs to protect vulnerable wellhead areas.

Although the States have primary responsibility for protecting and managing their ground-water resources, EPA works in partnership with them through programs mandated by the Clean Water Act, the Safe Drinking Water Act, and other national legislation. EPA intends to strengthen the progress the States have made over the past few years in ground-water protection by providing them with the financial, technical, and management tools they need to build on their current programs. One new initiative is to encourage each State to develop a comprehensive ground-water protection program to coordinate all of its programs affecting ground water.

### Ground-Water Uses



# Ground-Water Quality

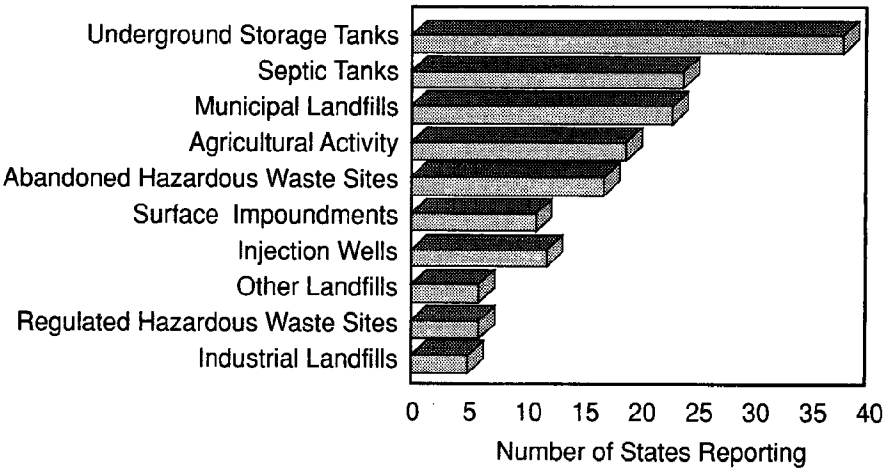
In general, States rank their ground-water resources as good to excellent in quality, with contamination occurring only in local problem areas. Many States are working to better understand the existing quality of their ground-water resources, to identify potential sources of contamination, and to determine the vulnerability of the resource to pollution.

In 1990, 42 States ranked their major sources of ground-water contamination. The most frequently cited sources were

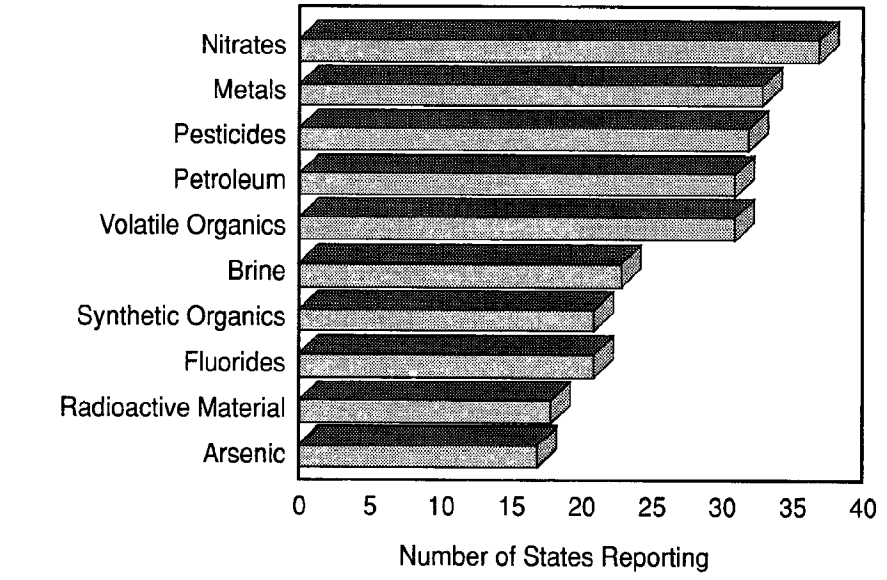
- Leaking underground storage tanks such as gasoline storage tanks at service stations and heating oil supply tanks for schools and public buildings;
- Septic tanks that leak nutrients, pathogens, and household wastes;
- Poorly managed or poorly located municipal landfills;
- Agricultural activities such as pesticide applications, irrigation, feedlot management, and manure spreading; and
- Abandoned hazardous waste sites such as those subject to cleanup under the EPA "Superfund" program.

States also identified the contaminants that originate from these sources of pollution. Nitrates were identified as a problem by 37 States, metals by 33 States, pesticides by 32 States, and petroleum products and volatile organic compounds by 31 States. ✣

## Sources of Pollution in Ground Water




## Top Ten Pollutants in Ground Water




John Thelgard

**Leaching of toxic chemicals from landfill sites is one of the many sources of ground-water contamination.**

# PROTECTING WATER QUALITY

The EPA works in partnership with State and local governments to improve and protect water quality. A number of laws provide the authority to develop and implement pollution control programs. The primary statute providing for water quality protection in the Nation's rivers, lakes, wetlands, estuaries, and coastal waters is the Federal Water Pollution Control Act of 1972, commonly known as the Clean Water Act.

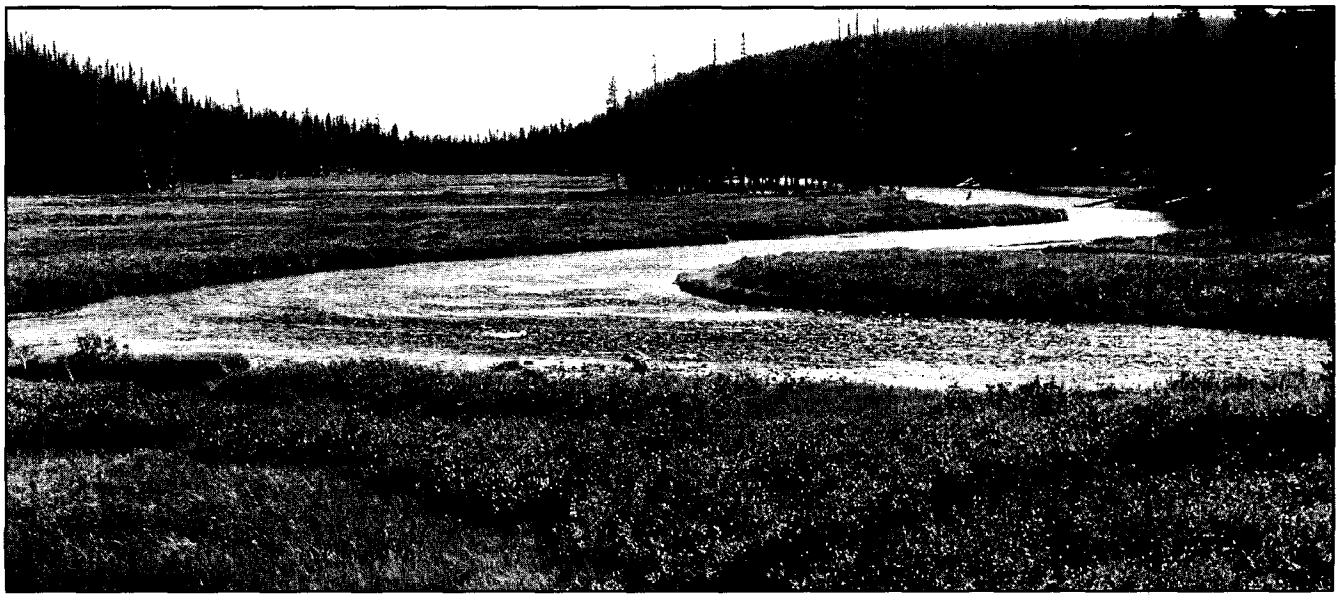
## The Clean Water Act

The Clean Water Act of 1972 and its amendments are the driving force behind many of the water quality improvements we have witnessed in recent years. Key provisions of the Clean Water Act provide the following pollution control programs.

- **Water quality standards and criteria** – States adopt EPA-approved standards for their waters that define the uses for those waters, and specific limits on pollution (known as criteria) to protect those uses.
- **Effluent guidelines** – The EPA develops nationally consistent guidelines limiting pollutants in the discharges of industrial and municipal sewage treatment facilities. These guidelines are then used in permits issued to dischargers under the National Pollutant Discharge Elimination System (NPDES) program. Additional controls may be required if receiving waters are still affected by water quality problems after permit limits are met.
- **Permits and enforcement** – All industrial and municipal facilities that discharge wastewater must have an NPDES permit and are responsible for monitoring and reporting levels of pollutants in their discharges. EPA issues these permits or can delegate that permitting authority to qualifying States. The States and EPA inspect facilities to determine if their discharges comply with permit limits. If dischargers are not in compliance, enforcement action is taken.

New amendments to the Clean Water Act now require permits for municipal sewers that carry stormwater separately from other wastes and serve populations of 100,000 or more and for stormwater discharges associated with industrial activity. The EPA is developing regulations to establish a comprehensive program to regulate storm sewers, including requirements for State stormwater management programs.

- **Grants** – The EPA provides States with financial assistance to help support many of their pollution control programs. These programs include the construction and upgrading of municipal sewage treatment plants; water quality monitoring, permitting, and enforcement; and developing and implementing nonpoint source pollution controls, combined sewer and stormwater controls, groundwater strategies, estuary and near coastal management programs, and wetland protection activities.



J. Michael McCarthy

- **Nonpoint source control** – The EPA provides program guidance, technical support, and funding to help the States control nonpoint source pollution. The States are responsible for analyzing the extent and severity of their nonpoint source pollution problems and developing and implementing needed water quality management actions.

- **Control of combined sewer overflows** – Under the National Combined Sewer Overflow Control Strategy of 1989, States develop and implement measures to reduce pollution discharges from combined storm and sanitary sewers. The EPA works with the States to implement the national strategy.

## Other Water Statutes

Other statutes that also guide the development of water quality protection programs include:

**The Safe Drinking Water Act,** under which States establish standards for drinking water quality, monitor wells and local water supply systems, and implement drinking water protection programs.

**The Resource Conservation and Recovery Act,** which establishes State and EPA programs for ground-water protection and cleanup and emphasizes prevention of releases through management standards.

**The Comprehensive Environmental Response, Compensation, and Liability Act,** which provides EPA with authority to clean up contaminated ground water. ✣

## Fish Consumption Restrictions

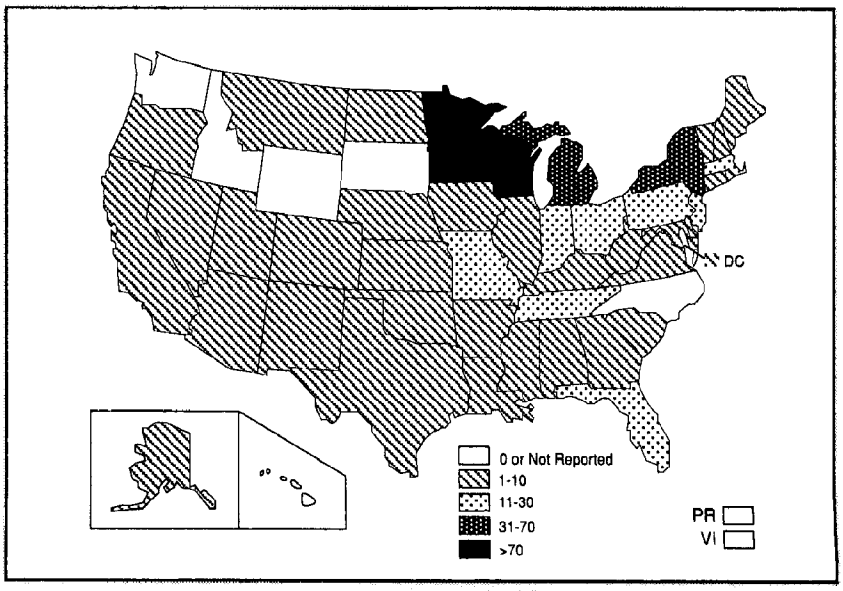
Toxic chemicals that enter rivers, lakes, wetlands, and estuaries may be absorbed or ingested by aquatic organisms that are, in turn, consumed by larger predators. These toxic pollutants can bioaccumulate in the tissues of fish and shellfish, which pose a potential health hazard to people who eat them. When States find toxic substances in fish tissue at concentrations exceeding established health standards, they issue fish consumption advisories or bans for the areas affected.

National statistics on fish consumption restrictions are incomplete. For example, in 1990, some States reported hundreds of restrictions and some reported very few. This may be more the result of differences in how fish are monitored and advisories are set than actual differences in water quality conditions.

In 1990, a total of 47 States provided information on the number of waterbodies with fish consumption restrictions in their waters. Forty-five States reported fish consumption advisories on 998 waterbodies.

The pollutants most commonly identified as causing fish consumption restrictions include PCBs, pesticides, dioxin, mercury, organics, and other heavy metals. States report that the leading sources of these pollutants are industrial discharges and polluted wet weather runoff from urban areas, storm sewers, agricultural lands, and resource extraction activities.

Reporting on fish consumption restrictions is improving as States increase their monitoring of fish tissue and establish stronger links between the reporting agency and the agency setting the consumption restriction. EPA has developed a computerized database of fish consumption restrictions based on State-reported data and expects that information sharing between database users will further improve the process used to establish and report fish consumption advisories. ✣




**Number of Fish Consumption Restrictions Nationwide**

# You Can Make A Difference

Federal and State programs have helped clean up many waters and slow the degradation of others. But government alone cannot solve the entire problem, and water quality concerns persist. Wet weather runoff, in particular, is everybody's problem, and everybody needs to solve it.

Examine your everyday activities and think about how you are contributing to the pollution problem. Here are some suggestions on how you can make a difference.

## Be Informed

You should learn about water quality issues that affect the communities in which you live and work.

Become familiar with your local water resources. Where does your drinking water come from? What activities in your area might affect the water you drink, or the rivers, lakes, beaches, or wetlands you use for recreation?

Learn about procedures for disposing of harmful household wastes so they don't end up in sewage treatment plants that can't handle them or in landfills not designed to receive hazardous materials.

## Be Responsible

In your yard, test your soil before you apply fertilizers, and look for alternatives where fertilizers might run off into surface waters. Consider selecting plants and grasses that have low maintenance requirements. Water your lawn conservatively. Preserve existing trees and plant new trees and shrubs to help prevent erosion and promote infiltration of water into the soil. Restore bare patches in your lawn to prevent erosion. If you own or manage land through which a stream flows, you may wish to consult your local county extension office about methods of restoring stream banks in your area by planting buffer strips of native vegetation.

Around your house, keep litter, pet waste, leaves, and grass clippings out of gutters and storm drains. Don't waste water when you wash your car. Never dispose of any household, automotive, or gardening wastes in a storm drain. Keep your septic tank in good working order.

Within your home, fix any dripping faucets or leaky pipes, and install water-saving devices in shower heads and toilets. Always follow directions on labels for use and disposal of household chemicals. Take used motor oil, paints, and other hazardous household materials to proper disposal sites such as approved service stations or designated landfills.

Center for Marine Conservation

**Citizen volunteers in Texas catalog and clean up beach debris.**

## Be Involved

As a citizen and voter there is much you can do at the community level to help preserve and protect our Nation's water resources.

Look around. Is soil erosion being controlled at construction sites? Is the community sewage plant being operated efficiently and correctly? Is the community trash dump in or along a stream? Is road deicing salt being stored properly?

It is important to know where your elected officials stand on water quality and environmental issues – and let your opinions be heard! Many communities have recycling programs; find out about them, learn how to recycle, and volunteer to help out if you can. One of the most important things you can do is find out how your community protects water quality, and speak out if you see problems.

## Volunteer Monitoring: You Can Become Part of the Solution

In many areas of the country, citizens are becoming personally involved in monitoring the quality of our Nation's water. As a volunteer monitor, you might be involved in taking ongoing water quality measurements, tracking the progress of protection and restoration projects, or reporting special events, such as fish kills and storm damage.

Volunteer monitoring can be of great benefit to State and local governments. Some States stretch their monitoring budgets by using data collected by volunteers, particularly in remote areas that otherwise might not be monitored at all. Because you are familiar with the water resources in your own neighborhood, you are also more likely to spot unusual occurrences such as fish kills.

The benefits to you of becoming a volunteer are also great. You will learn about your local water resources and have the opportunity to become personally involved in a nationwide campaign to protect a vital, and mutually shared, resource. If you would like to find out more about organizing or joining volunteer monitoring programs in your State, contact your State department of environmental quality, or write to:

U.S. EPA
Volunteer Monitoring (WH-553)
401 M St. SW
Washington, DC 20460

For further information on water quality in your State, write to your State department of environmental quality. Additional water quality information may be obtained from the U.S. EPA and Regional offices of the U.S. EPA (see inside back cover). ✣

## For Further Reading


U.S. EPA. 1988. *America's Wetlands: Our Vital Link Between Land and Water*. Office of Water. OPA 87-016.

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